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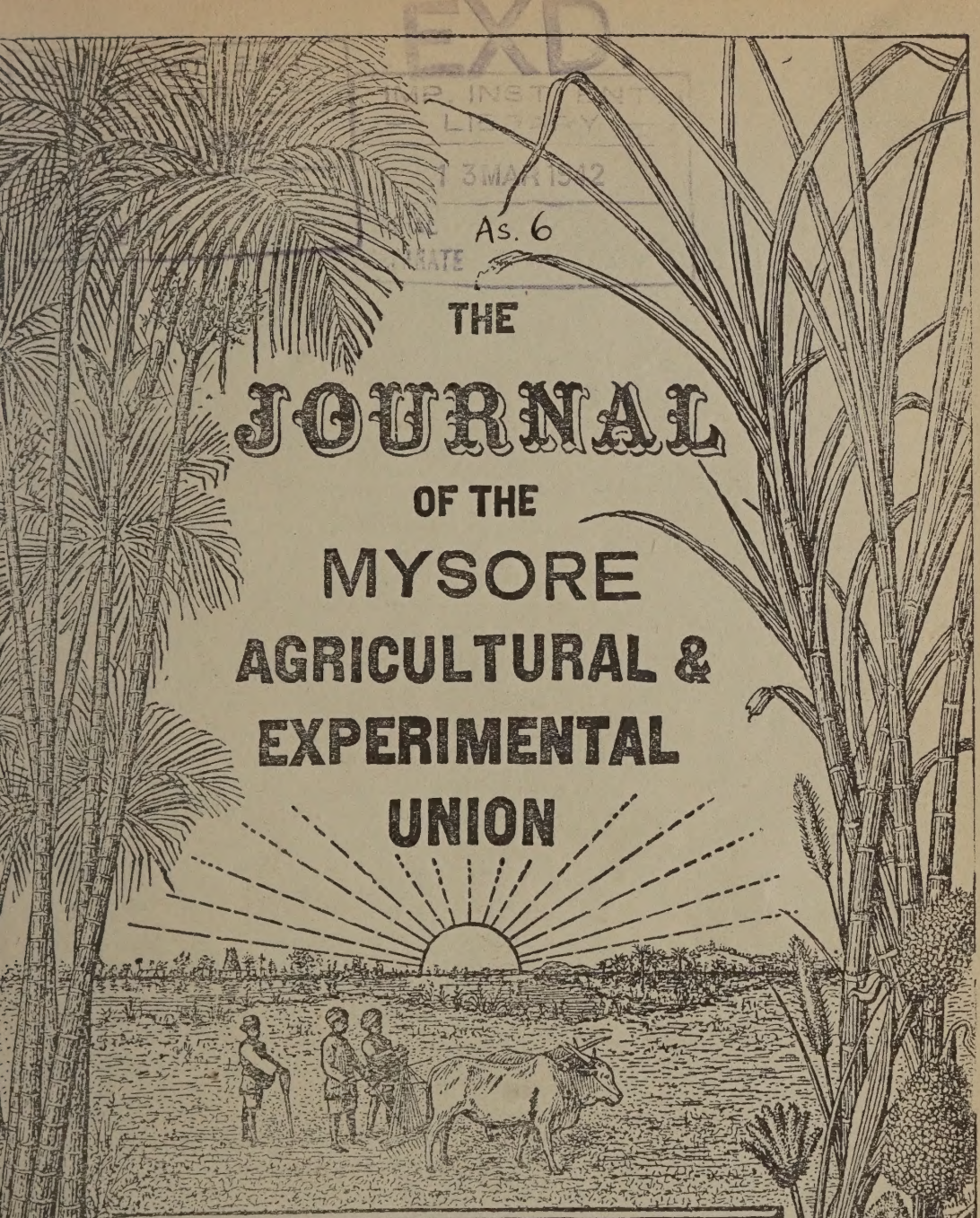
THE JOURNAL OF THE MYSORE AGRICULTURAL & EXPERIMENTAL UNION



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THE JOURNAL OF THE MYSORE AGRICULTURAL AND EXPERIMENTAL UNION

A quarterly magazine devoted to the advancement of Agriculture and published by the Mysore Agricultural and Experimental Union

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V. N. Ranganatha Rao

The Journal
of the
Mysore Agricultural
and
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Vol. XVIII] OCT.—DEC. 1939 [No. 2

Mysore Cottons and Their Improvement—III

By
V. N. Ranganatha Rao

(Two new forms possessing red flower and green seed developed from interspecific hybridization between (G. arboreum and G. herbaceum)

Historical and Introductory

Sir George Watt, in his work *'The Wild and Cultivated Cottons of the World'*, has made constant reference to the valuable red flower cotton grown in India in the long past. There are sufficient grounds to believe that the cotton which Hove found to be the 'Dyva Narma Capass' of Broach and Duthie and Fuller found to be the 'Narma' or 'Nanna' of Oudh, answers to the species *G. arboreum*. Gulati and Turner working on an extremely small piece of fabric and yarn unearthed during the excavation of Mohenjodaro have arrived at the conclusion that the cloth spun was from the cotton belonging to the *arboreum* type. According to Dr. Burns, *G. arboreum* was grown as a regular field crop even as late as 1884.

After frequently mentioning the superiority of the cotton and stating that "*Gossypium arboreum* proper has to be accepted as the typical condition of an extensive assemblage of forms, races or hybrids which all originated in the Old World", Sir George Watt makes a valuable suggestion that the subject of these once-field cottons of India should be renewed for fresh and exhaustive study. As most of the varieties of cotton (except *G. sanguineum*), as at present grown, possess yellow or white flower and as Dr. Leake has pointed out a distinctive character recognisable in the vegetative condition has distinct advantages as it facilitates enormously the inspection of fields sown to such a type, this is an additional reason in support of recovering red flowered cottons.

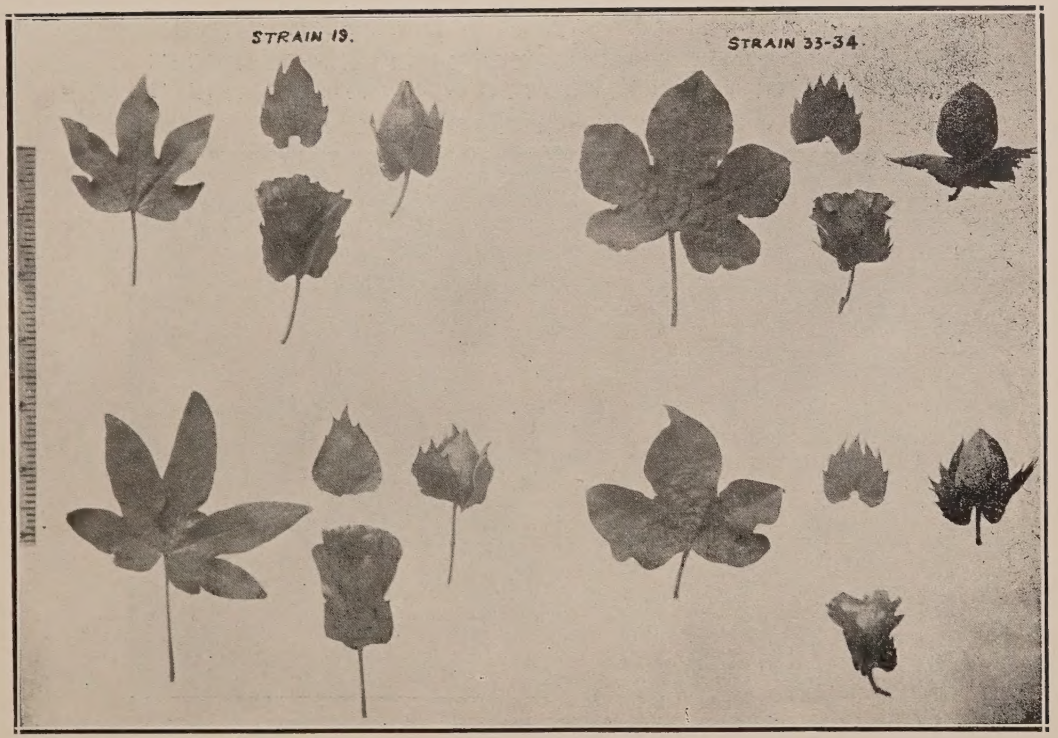
Resume of the Work on the Interspecific Hybridization between *G. arboreum* and *G. herbaceum* (Sel. 69)

A paper (4) reviewing the work, that is being done in connection with the development of red flowered strains through interspecific hybridization was presented by the writer to the 1936 Sessions of the Indian Science Congress. It was pointed out in that paper that "the problem of improvement of Asiatic cottons seems to lie in the full utilisation by synthesis of economic characters scattered throughout the herbaceum and arboreum groups" (Harland).

With the object of developing strains possessing red flower, green seed and silky long staple, a cross was made between a strain of local herbaceum (Sel. 69) and the tree cotton *G. arboreum*, and on the basis of three characters, namely, leaf shape, flower colour, and seed colour, eight forms were separated in F2. and selections within these on economic characters namely, low fruiting branch, size of the fruit, staple length and ginning out-turn were made from F3, and onwards with the result that we have now in our possession three strains homozygous to the above three respective characters with long staple and high ginning out-turn. In that paper it was pointed out that one of these

developing broad leaf, yellow flower and green seed (H. 190) had reached the stage of distribution amongst the cotton growers, and, the other two strains, *viz.*, strains 19 and 33–34 possessing broad leaf, red flower and green seed are discussed in this paper; one of the latter, *viz.*, strain 19 is now in a position to be realised.

	G. arboreum	*G. herbaceum*
1.	*Habit.*—Perennial tree cotton having red stem with many long vegetative branches	Annual bushy cotton with few vegetative branches but many fruiting branches
2.	*Hairiness of the stem.*—Smooth or slightly hairy	Very hairy
3.	*Branching habit.*—Many vegetative branches which are long and trailing; fruiting branches developed by extra axillary bud. No secondary vegetative branches right through the fruiting zone	Few vegetative branches at the bottom of the stem. In the middle zone two branches develop axillary bud giving rise to extra-axillary fruiting branches
4.	*Leaf.*—	
	Petiole—Red and smooth ..	Green and hairy
	Blade—Red and smooth, deeply divided ..	Green and leathery (wrinkled) Big and Broad
5.	*Bracts.*—(Investing the bud) ..	Flaring away from the bud
	Colour—Red ..	Green
	Shape—Triangular longer than broad ..	Triangular broader than long
	Apex—With four teeth ..	Many teeth
	Union—Often united at the base ..	Slightly free
6.	*Flower.*—	
	Petals—Red and big with dark spot ..	Yellow and with a dark spot
7.	*Staple.*—	
	Length—1"	$^{7}/_{8}$"
	Feel—Silky	Slightly rough
8.	*Fruit.*—	
	Colour—Red	Green
	Shape—Narrow and conical pitted tapering	Round and wide—not rounded pitted
	No. of locks—Generally three	Generally three and four
9.	*Seed.*—	
	Size—Big	Small
	Shape—Oval with a point ..	Round
	Colour—Green	White
10.	*Ginning percentage.*—23 per cent.	27–29 per cent.



Leaves and Bracts

33–34. A detailed study of these was made on the above characters.

From the above statement, it is seen that both these forms differ considerably in habit,[1] method of branching and flower colour (deep red and dilute red), one of them resembling the male parent and the other female except in the flower colour.

That the cotton plant develops specialised forms of branches has been noted by all cotton-workers and a detailed study of the plant has been made and published.

The buds arise at the base of each leaf on the main stem of the plant one axillary and the other extra-axillary. These buds give rise to two different kinds of branches. The branches that give rise to flower and fruit, generally known as fruiting branches, come from extra-axillary bud, while the limb or vegetative branch is developed from the axillary bud.

The main stem which is a monopodium may be divided into three zones. The lowest portion at the base is "Vegetative Zone" where only one bud develops giving rise to vegetative branch. On the other hand, in the middle portion of the plant we find in some varieties both the buds developing, the axillary giving rise to vegetative branch and the extra-axillary to the fruiting branch, while in the top portion only one bud develops giving rise to fruiting branch; on the other hand in other varieties we find only developing at the base and higher up only fruiting branches. In plants having the latter branching system, we get tertiary fruiting branches developing early and giving rise to flowers and fruits.

We have both the above conditions represented respectively in the two new types. In strain 19, which resembles in many respects *G. arboreum*, we have the second form of branching, *i.e.*, only fruiting branch appearing in the middle

[1] It (*viz.*, plant habit) is of considerable taxonomic value, as the recent evolutionary trend throughout the cultivated sections of the Genus appears to have been from the perennial predominantly monopodial habit to small early flowering, early maturing, annual predominantly sympodial bushes (Hutchinson and Ghouse, p. 236).

zone while in strain 33–34 we find both the buds growing, giving rise to the two types of branches as in herbaceum.

There are indications of correlation[2] between the habit of the plant, shape of the leaf, method of branching, behaviour of bracts and colour of flower and seed.

In their classification of the Asiatic cottons, Harland and Hutchinson (5) have made the behaviour of bracteoles a diagnostic character in separating the two species *G. arboreum* and *G. herbaceum.* While in arboreum the bracteoles invest the boll, those of the herbaceum flare back (half) from the mature bolls.

We have in the strain 33–34 which possesses dilute red flower and green seed as in arboreum the behaviour of the bracteoles instead of "investing" resemble herbaceum in flaring away from the boll. This has an economic bearing as will be pointed out later on. How far this fact is heritable is being studied.

Practical Significance of these New Forms

As mentioned above the difference in the colour of the flower and the seed, gives an easy key to the spotting of impurities and thus helps to maintain the strain in a pure condition.

The branching habit in the strain 19 where the middle and higher zones only have the extra-axillary branch as in plants developing this system of branching, produces tertiary fruiting branches in the secondary vegetative branches early at the base of the plant.

The flaring away of the bracteoles from the mature boll allows clean picking of cotton. This point along with the photo-synthetic function of these will be fully discussed in a subsequent paper, quoting the work of Dr. Kearney.

If this character-behaviour of the bracts is a transmittable one, than we have every hope of developing a strain

[2] There is in Asiatic cottons however, a strong correlation between the shape of the leaf lobe, the shape of the bracteoles and the type of surface (whether pitted or smooth of the bolls *x x* " the grou " as a whole exhibits a series of correlated forms, which are the most valuable criteria for the separation of the Asiatic from the American species and of the Asiatic species from each other" (Hutchinson and Ghouse, "The classification of the cottons of Asia and Africa," *The Indian Journal of Agricultural Science,* Vol. VII, Part II, April 1937, p. 237).

Cotton Plant—Strain 33-34. Bushy habit resembling female parent (Sel. 69—*G. herbaceum*)

with big fruits of *G. cernuum* and bract behaviour of *herbaceum* in the cross which is in progress between C. No. 86 (developed by hybridizing *G. obtusifolium* and *G. cernuum* with strain 19 (developed by crossing *G. arboreum* and *G. herbaceum*); C. N. 86 develops big bracteoles after one of its parents *G. cernuum* but they invest the fruit (the character of *G. arboreum*). On the other hand, in strain 33–34 the bracteoles flare away from the fruit as it ripens (the character of herbaceum) and as this character is transmitted to a strain resembling arboreum there are hopes of deriving a plant possessing the big fruit and the bract of *cernuum* and at the same time the bracteoles turning away from the fruit to enable clean picking of cotton, as the dried bracts will be far removed from the seed cotton, and thus the chances of admixture are avoided.

H. 190 Cotton in T-Narsipur Area—A Field Observation

(Report No. 1301 dated 25th June 1939 from the Agricultural Inspector, Chamarajanagar, to the Assistant Director of Agriculture, Mysore Circle, Mysore)

In accordance with the report required by the Economic Botanist about the performance of H. 190 cotton in this locality I beg to submit the following figures.

Its yield at Nilsoge compared with Karunganni has been as follows:—

Variety	Area sown	Yield	Yield per acre
H. 190 ..	16 guntas	129 lbs.	11·5 mds.
Karunganni ..	6½ acres	1,404 lbs.	7·7 mds.

At Agara where there was no H. 190 to compare with it, C. 7 has given a first crop of 5·23 mds. in a half acre plot, *i.e.*, 10·46 mds. per acre.

In this locality the possibility of taking a second crop counts much with the ryots. Observations made during this

week at Nilsoge showed that Karunganni had fruited fairly well the second time also whereas H. 190 had still a few flowers only. In the Kurubur plot H. 190 and C. 7 had fruited equally, *i.e.*, only to a small extent. In the Agara plot visited earlier, C. 7, late verum and M.A. II had all fruited well for the second time also.

The sample of H. 190 obtained from the Babbur Farm was ginned at Mugur. It gave a ginning percentage of 28·3. Both seed and lint were appreciated by the persons present. The difference between H. 190 and Karunganni seeds is conspicuous in the case of H. 190 from the farm. But the difference between H. 190 and Karunganni samples obtained locally here is not so impressive perhaps on account of the season.

Permission has been requested for issuing the H. 190 obtained from the Babbur Farm consignment for an 'A' Farm to increase the stock of H. 190 seed here.

Sugarcane Borers and Their Control in the Mysore State*

By

T. V. Subramaniam

Entomolagist, Mysore State

Introduction

It is perhaps common knowledge that the extensive cultivation of sugarcane all over India in recent years has contributed a good deal to the increase in the toll levied by pests of all kinds. Among pests of cane what are known as borers occupy a conspicuous rank. In this paper it is intended to present very briefly a general account of the bionomics of the borers in the Mysore State and the remedial measures so far adopted. Different kinds of borers attacking sugarcane, commonly known as *moth borers*, have been recorded as the most important enemy of the cane crop in almost all sugarcane growing countries of the world, *viz.*,

* Paper read at the Indian Science Congress, Lahore, January 1939.

United States of America, Mexico, Java, Philippine Islands, West Indies, British Guiana, etc. In India also, the *moth borers* have been found to be the most important enemies of the sugarcane crop in all the cane-growing provinces.

In Mysore previous to the advent of the Sugar Factory at Mandya, although a large acreage was under sugarcane, it was all in isolated patches and the borer pest was noticed only off and on in the areas in any serious form. After the establishment of the Sugar Factory, when thousands of acres began to be brought under cane cultivation all around the Factory, the borer pest got a firm foot-hold, with facilities for continuous breeding. Investigations were started on the study of the different borers under these altered conditions from the very beginning and it has been found that if the attack of borers is prevented in the early stage of cane growth, *i.e.*, upto about three months from planting, the canes will be able to grow very well and the moth borer incapable of causing any appreciable damage.

Kinds of Borers

The important categories of borers which cause the greatest amount of damage to sugarcane in this State are the "dead heart borers" and the "top shoot borers"—*Argyria sticticraspis* Hmp. and *Diatrea venosata* Wlk., being the dead heart borers and *Scirpophaga nivella* F. and *S. monostigma* Zell., the top shoot borers. We have noted other borers also of minor importance in Mysore, *viz.*, *Sesamia inferens* Wlk. and *S. uniformis* Ddgn. being shoot and stem borers and *Emmalocera depressella* Swinh. the root borer, but these are of little importance compared to the first two categories.

Nature and Extent of Damage

Dead heart borers.—In case of the dead heart borers, the young larvæ hatching out from eggs take shelter in between the stem and tender leaf sheaths of the young plants. They remain as leaf miners for sometime, bore into the stem close to the soil level, enter the stem and remain feeding

on portions of the central shoot thus causing "dead hearts". When they have exhausted the food there, they come out to attack fresh shoots and suckers which are found and thus prevent a good stand of cane in the fields. In the later stages of development of the canes, excepting some damage done to the eye buds, no further injury is caused. Severe infestation in the early stages of cane growth has caused large areas of cane to be completely ploughed and replanted.

Top shoot borers.—Top shoot borers generally attack grown-up canes, *viz.*, canes of over three and four months' growth. In this case all further growth of the plant is checked and the tonnage at harvest is greatly reduced.

Control Measures

The important control measures we have adopted with some success against the "dead heart borers" are (1) Cultural, and (2) Biological.

(1) *Cultural method.*—The chief cultural method we employed consisted in giving a light earthing up by means of a light mould board plough along both sides of the rows of cane when the shoots are about a month old. By this operation the soil on both sides of the young cane rows are thrown over the shoots, thus covering the first leaf sheath. An irrigation is also given soon after. The young larvæ in the leaf sheaths are smothered and killed, and the older ones in some of the stems showing dead hearts find it impossible to come out of the mass of soil to damage fresh shoots. The first leaf sheaths are pulled out and destroyed with the larvæ in them in case there is a slight delay in earthing up. It has been found that the larvæ in hatching out of eggs laid by the moths after this earthing up operation are unable to cause any damage to the normal growth of plants. For want of proper resting places lower down the stem, the larvæ take shelter in the top whorl of leaves. Although many larvæ attempt to bore down the stem from the top, owing to the rapid growth of the cane shoots, they have not been found to cause any appreciable damage to the plants. A special staff of fieldmen employed by

Government have been doing propaganda work for the last three years in the villages and as a result, nearly 4,700 acres of young canes were protected last year.

The harvesting results obtained in 47 villages, where earthing up of canes was done in areas ranging from 5 acres to ½ acre during the years 1936 and 1937, were examined statistically. It is found that the earthing up treatment has increased the yield by about seven tons of cane per acre.

(2) *Biological method.*—A parasite laboratory was established in the heart of the cane area for a large-scale production under laboratory conditions of the insect *Trichogramma minutum* Riley., the chalcid egg parasite of the dead heart borers. 8½ million parasites were reared out in this laboratory in 1936–37 and 23 millions in 1937–38. In 1936–37 over 4 million parasites were released in about 200 acres of young cane fields and the rest were utilised for further breeding. In 1937–38, 10½ million parasites were released in an area of over 600 acres of cane. The laboratory equipment, etc., is now found sufficient to produce parasites to cover 1,000 acres of cane every year. Results of preliminary experiments conducted on the Government Farm show an increase of from 5 to 8 tons more of cane from parasite released areas. Increase from a minimum of 29% to a maximum of 77% of parasite action on the host eggs has been noticed in colonised areas. It has been noticed recently that due to the release of *Trichogramma* egg parasites over large areas of cane, the natural parasitisation of *Argyria* and *Diatræa* egg masses in uncolonised areas has also gone up considerably, *viz.*, 43·4% as against 2% to a maximum of 15% when the work was first started. Complete figures for increase in tonnage of canes as a result of large-scale parasite release are being collected and will be available as soon as possible.

For the top shoot borers, control methods consist of (1) the systematic hand picking of the conspicuous white moths and egg masses by gangs of children in the cane areas and (2) the regular collection and release in the fields of the natural parasites which emerge from the masses of eggs

collected weekly. This work was started last year and during the past year 3,01,600 moths and 8,17,000 egg masses have been collected and properly disposed of. Payments made to these gangs of children included also rewards for collection of *Argyria* moths and their egg masses and also for the destruction of infested cane top shoots with borers *in situ*. This last item included over 1,40,000 top shoots.

Natural Enemies

(1) The "dead heart" borer eggs are found parasitised by *Telenomus dignoides* Nixon (Proctotrupidæ) in addition to *Trichogramma minutum* Riley. The larvæ are parasitised by the wasp *Apanteles flavipes* Cam. and a Tachinid fly *Winthemia semeberberis* Bezzi.

(2) Top shoot borer eggs are parasitised by the wasps *Tetrastichus* and to very small extent by *Trichogramma minutum* Riley. The larvæ are parasitised by

1. *Elasmus zhentneri* Ferr.
2. *Bracon famulus* Binghan.
3. *Rhaconotus scirpophaga* Wlk.

For further details on this subject of cane-borers and their control in the Mysore State reference may be made to the author's published papers.*

Report of the Secretary, M. A. & E. Union, Bangalore, for the 20th Annual General Meeting

That we have met here just when the Silver Jubilee of the Mysore Agricultural School, Hebbal, is being celebrated is, I believe, as appropriate as it is unique, and will explain to you why we have met at such a short notice. An occasion when such a large number of varieties of ragi, paddy and sugarcane are to be seen at their best is not one to be missed by our members. The Union was organized more than twenty years ago with the object of bringing together the trained

* "Sugarcane borers and their control in the Mysore State," 1934, Circular No. 53, *Mysore Agricultural Department*.

"Sugarcane borer control in the Mysore State," 1935, Circular No. 55. *Department of Agriculture, Mysore State*.

"Preliminary experiments on the mass production of *Trichogramma* parasites for control against sugarcane borers in Mysore," *Indian Journal of Agricultural Science*, 1937, Vol. VII, Pt. I.

agriculturists of the School, other agriculturists engaged in farming and the members of the Staff of the Mysore Agricultural Department for the purpose of developing the agriculture of the State. The Union is therefore closely associated with the progress of the Agricultural School. Provision is also made in the constitution of the Union to admit students in residence at the Hebbal School, as its associates without payment of any fee. As its founders instituted it, the Union, we see, has in it the scope to develop a popular school of scientific agriculture in Mysore.

The Union has thus a call for all the individuals interested in, or connected with Mysore agriculture, but its special function consists of the work of a number of farmers who are its members, who try out new seeds, manures and other improvements in the field and thus co-operate with the Department of Agriculture to ascertain which improvements are suited to particular localities. Demonstrations in ryots' plots are planned by thousands now by the Department and lest the utility of the Union be doubted from this point of view, the Director of Agriculture has particularised the difference between demonstration plots and plots raised in the holdings of the members of the Experimental Union, stating that in the former case, the demonstration of a well-proved fact is implied, while in the latter case what is implied is an experiment simultaneously with the efforts of the Department, concerning which, the members, conscious as they are of what they are doing, come forward to take certain risks if need be. The Department is developing a scheme of subvention farms for experimental trial of several good varieties of crops to find which best suits a particular area. These are helped with subventions. They are also developing seed farms for multiplication of pure seed to be purchased at a premium by the Department for distribution. These are useful opportunities for members of the Union to take a larger part in agricultural improvement in the State.

The central business of the Union, namely, the conduct of the English and Kannada Journals is being carried on chiefly with the subvention kindly granted by the Government and subscriptions collected from members and subscribers. In pursuance of the resolution passed at Mandya, by the Union on 17th December 1938, the Director of Agriculture was kind enough to approach the Government to continue their kind help and in their order No. D. 9056–57/Agri. 229–38–4 dated Bangalore, 15th April 1939, the Government have kindly granted a subvention of Rs. 2,000 per annum for two more years from 1939/40.

I may now be permitted to submit a comparative statement of our members and subscribers.

Particulars	As on 10–7–1939	As on 15–12–1938	As on 11–11–1939
(*a*) *Kannada Journal*:			
1. Members ..	36	32	30
2. Subscribers—			
(i) Schools ..	43	114	85
(ii) Village Panchayats ..	48	37	8
(iii) Others ..	15	10	14
3. Exchange ..	17	19	21
4. Free List ..	10	10	10
(*b*) *English Journal*:			
1. Members—			
(i) Official ..	44	44	59
(ii) Non-official ..	38	41	46
2. Subscribers ..	29	30	38
3. Exchange ..	78	82	81
4. Free List ..	11	11	11
(*c*) Total number of Members ..	118	117	135
„ „ Subscribers	135	191	145

The following is an estimate of the expenses of the Union for an year as at present:—

Establishment: present allotment per month	Rs. 136 0 0	Rs. 1,632 0 0 (p.a.)
Kannada Journal, printing per number	„ 50 0 0	„ 600 0 0 (12 issues)
English Journal, printing per number	„ 125 0 0	„ 500 0 0 (4 issues)
Miscellaneous expenses		„ 100 0 0
	TOTAL	Rs. 2,832 0 0

Against this we have the following resources:—

Government subvention	Rs. 2,000 0 0
Subscription from members and subscribers (280 × 3)	„ 840 0 0
Advertisement charges	„ 70 0 0
TOTAL	Rs. 2,910 0 0

Though the two sides just balance it is seen that the Union is not self-supporting and also it requires better finance to illustrate the Journals more profusely. The Kannada Journal especially is lacking in illustrations generally.

We have now only 135 members as seen from the progress report. This indicates the need for more propaganda to enrol members, wherein the Union anticipates the good offices of all those who have already joined it. The Department is now using its influence to add more members from the Departmental Staff. I take this opportunity for appealing to you to kindly use your influence to add new members from among your friends.

I submit now the Statement of Receipts and Expenditure for the year ending 30th June 1939.

Receipts	Rs.	A.	P.	Expenditure	Rs.	A.	P.
Opening Balance	994	9	3	Establishment	1,631	10	2
Admission Fee	13	0	0	Printing Charges	588	13	0
Membership Fee	105	0	0	Postage & Telegrams	31	11	0
Subscription	445	9	0	Contingency (Miscellaneous)	23	12	0
Miscellaneous Receipts	71	7	11	Annual General Meeting & Field-Day expenses	68	3	3
Subvention for 1938–39	2,000	0	0	Closing Balance	1,285	8	9
Total	3,629	10	2	Total	3,629	10	2*

**Expenditure pending:—*

1. Establishment for June 1939 .. .. Rs. 136 0 0
2. Press Bills pending payment .. .. „ 411 0 0
3. Balance to meet the cost of printing English and Kannada Journals pending publication .. „ 738 8 9

Total Rs. 1,285 8 9

M. Vasudeva Murthy,
Secretary.

From Our Co-operators

"The foremost problem of the Department is how to bridge the gulf between the Departmental farm and the raiyats' holding and how to incorporate into the raiyats' cultural practices the improvements in agriculture adopted in the Department farms. It is therefore of the greatest importance that the economic advantages of the improved varieties of crops and improvements in manuring and cultural methods should be demonstrated in the raiyats' fields and with the labour and resources available to him from day to day," observes the Director of Agriculture in his article on 'Demonstration Plots in Raiyats' Fields' in the Mysore Agricultural Calendar for 1939. Further in the same article it has been stated that with a view to accelerate the adoption of improvements in agriculture by a widening circle of raiyats a scheme of systematically laying demonstration plots in raiyats' fields was sanctioned by Government in their Order No. 1108–9 A. & E. 16–37–2 dated 31st July 1937. From grants sanctioned for 1937–38 in accordance with order about 1933 demonstrations were arranged in the raiyats' fields.

The following are the opinions of a few co-operators who conducted the demonstrations in their holdings. About 4,000 plots are being arranged in the current season.

Ragi

1. *K.* 1 *Ragi.*

Mr. Murugappa, B.A., LL.B., Hassan, writes:

"I have grown K. 1 ragi in 8 acres. As the crop was very satisfactory, the yield was estimated at 8 pallas of grain and 2½ cartloads of straw per acre. I feel it very happy to intimate that this crop was awarded a certificate at the Exhibition of the State Women's Conference, held at Hassan and a silver medal at the Hassan Cattle Fair."

Mr. H. K. Chandrasekhariah:

"My neighbouring raiyats are very anxious to take to this strain of ragi. It is estimated that 8 pallas of grain and

2½ cartloads of straw can be raised from one acre of land. And I feel it gratifying to report that a certificate was awarded to the standing crop of this ragi, when plants were shown at the Exhibition of the Mysore State Women's Conference held at Hassan."

Mr. T. S. Ramanna of Sulabele, Hoskote Taluk:

"I have grown 1,260 seers of ragi and 5 cartloads of straw per acre. I think the local strains do not yield as much."

Mr. Muhamad Khan of Sulabele, Hoskote Taluk:

"A plot of 1½ acres has yielded 1,800 seers of K. 1 ragi and 6 cartloads of straw."

Mr. Devaraju, Hoskote Taluk:

"K. 1 ragi yield per acre in my land is 1,280 seers."

Mr. Venkatappa of Attibele, Hoskote Taluk:

"1¾ acre of my garden has yielded 1,080 seers of K. 1 ragi."

Mr. Boregowda of Chikkanahalli, French Rocks Taluk:

"I have grown K. 1 ragi on 15 guntas at 440 seers per acre."

Mr. Garalapuriah of Agrahar Bachalli, Krishnarajapet Taluk:

"By growing K. 1 ragi on 20 guntas of my land, produce that could be reckoned at 800 seers per acre was obtained."

Mr. Anniah Reddi, Chairman, Village Panchayat, Madivala, Bangalore:

"K. 1 ragi broadcast yielded 1,100 seers of grain and 1,400 lbs. of straw in my land. The same strain when transplanted yielded 1,280 seers of grain and 1,500 lbs. of straw. Local *gidda* ragi transplanted by the side yielded 820 seers of grain and 1,620 lbs. of straw per acre."

Mr. Sreenivasiah, Korachekere Kaval, Basavapatna, Holenarsipur Taluk:

"I grew K. 1 ragi on 10 guntas of land. 103½ seers of grain was secured. Local ragi in the same extent of land gave just 83 seers of grain. K. 1 ragi is heavier than the local measure for measure and yields better flour."

Mr. K. Maligappa, Vadigenahalli, Devanahalli Taluk:

"I grew K. 1 ragi supplied by the Department in a plot of 6½ guntas and got therefrom 320 seers of grain and 1½ cartloads of straw."

2. *H. 22 Ragi.*

Mr. T. V. Narasingappa, Member, Mysore Representative Assembly, Kadur District Board, and Tarikere Municipal Council:

"On sowing this strain of ragi in 3¼ acres, I have found it superior to the local *dodda* or *gidda* ragi in all respects. This ripens earlier by about a fortnight than the local variety; the grains are red, heavy and uniform in size. If the crop is reaped late, the grains may shed in the fields to some extent. On transplanting, the seedlings tiller freely but broadcasting results in moderate tillering. The grain of the strain commands a better price than the local variety; but the straw is rather thick and coarse. No disease or pest seems to have attacked the crop during the period of growth. Because of transplanting the seedlings 1¼ acres could yield 1,260 seers of ragi which works up to 1,008 seers per acre. On broadcasting over 2 acres of land, the yield was only 1,440 seers, the yield per acre being 720 seers."

Mr. G. V. Shankarappa, Gaddehosur, Krishnarajapet Taluk:

"A plot of 20 guntas of my field has yielded H. 22 ragi at 500 seers per acre."

Mr. G. Ramaswamy, Chairman, Village Panchayat, Gunjur, Chintamani Taluk:

"Five acres of my land was sown under this crop, the growth of which was quite satisfactory. 2,965 seers of ragi was harvested, the yield per acre working to 593 seers. The plants with well-developed earheads were taller than the local variety."

Mr. K. B. Lakshmana Reddy, District Board Member and Lond-lord, Kagathi, Chintamani Taluk:

"The crop at first was quite satisfactory but as the rains failed in the middle, there was a decrease in the

expected yield. 2 acres yielded 1,040 seers of grain and 5 cartloads of straw."

Mr. K. Srinivasiah, Munthakadirenahally, Ambaji Durga Hobli, Chintamani Taluk:

"I have harvested 840 seers of H. 22 ragi over 1½ acres, the yield per acre being 560 seers."

Mr. Thimmiah, Talwar, Kaiwar Hobli, Chintamani Taluk:

"Two acres of my field under this strain has yielded 960 seers of grain, the yield per acre being 480 seers."

Groundnut

1. *H. G. 1 Groundnut.*

Mr. Doddathimmappa, Bommenahalli, Chitaldrug District:

"An yield of 14 maunds of groundnuts for 26 lines has been harvested on an area of ¼ acre under H. G. 1; whereas in the neighbouring plot of the same extent under local groundnut, an yield of only 10 maunds was produced. Under well-irrigated conditions H. G. 1 variety seems to do well."

Mr. P. Ramiah, Patel, Deshahalli, Bowringpet Taluk:

"Half acre has yielded 720 seers of H. G. 1 groundnut. On a neighbouring plot of the same area under the local variety a crop of only 360 seers has been harvested."

Mr. Munimylappa, Kadirinayakanhalli, Sidlaghatta Taluk:

"On sowing H. G. 1 variety 1,200 seers of groundnut per acre was harvested, while on a plot of the same area only 960 seers of the local Chittur variety could be obtained."

Mr. Muniswami Gowda, Anur, Sidlaghatta Taluk:

"H. G. 1 variety gave 840 seers of groundnut per acre, while the local Chittur groundnut yielded 680 seers per acre."

Mr. Aleri Chennappa, Bhaktarahalli, Sidlaghatta Taluk:

"I have grown 1,040 seers of H. G. 1 groundnut per acre; the local variety yielded 960 seers per acre in a similar plot.

Mr. S. Purniah, Nadapinayakanhalli, Sidlaghatta Taluk:

"H. G. 1 groundnut yielded 1,280 seers per acre while the local groundnut yielded 1,200 seers."

Mr. Peddanna, Venkatapally, Sidlaghatta Taluk:

"I put one acre of land under H. G. 1 groundnut. The quantity of groundnuts I obtained amounted to 1,200 seers. The local variety in similar area resulted in 1,040 seers."

Mr. B. Venkata Rao, Kasba Hobli, Sidlaghatta Taluk:

"In my land H. G. 1 has yielded 950 seers per acre as against 900 seers of the local variety."

Mr. Bhadragiri Gowda, Dodmalur, Channapatna Taluk:

"I tried H. G. 1 groundnut in ½ an acre and Valencia in another ½ an acre. I got 800 lbs. of H. G. 1, *i.e.*, 1,600 lbs. per acre and 864 of Valencia, *i.e.*, 1,728 lbs. per acre."

Mr. Krishna Iyengar, Byrapatna, Channapatna Taluk:

"I grew H. G. 1, Valencia and Spanish varieties of groundnut in my lands this year and they have yielded 857, 1,760 and 1,650 lbs. of nuts per acre respectively.

Paddy

Mr. T. D. Venkataramiah, Shanubhog, Tumkur:

"I had 7½ guntas of land ploughed by the iron plough according to the suggestion of the Agricultural Department, cultivated with the six-shovel cultivator and sown with a few strains of paddy. Seed was selected in salt water. Before sowing paddy, sunnhemp was grown in the plot and ploughed under for green manure. Out of the 3 varieties of paddy experimented with, *Halubbalu* resulted in 1,774 seers of grain per acre, *Basumathi*, 1,488 seers and *Chintamani Sanna* 2,128 seers per acre."

Mr. D. Seetharamiah, Tumkur:

"I raised separated nurseries of *Basumathi*, *Chintamani Sanna* and *Halubbalu Sanna* paddies, sowing the seeds on 1–1–1938. The nursery plots were manured with cattle manure and 3¾ lbs. of ammonium sulphate. To the plot

taking the paddy crop, I applied 18 lbs. of *honge* leaves, 450 lbs. sunnhemp green manure, 1 cartload of cattle manure, 20 lbs. ammonium sulphate, 15 lbs. superphosphate and 5 mds. of *honge* oil-cake. This plot was divided into 3 portions of 3 guntas each and one variety of paddy transplanted in each portion on 31–1–1938. The crop was harvested on 11–5–1938 with the following results :—

	Plot yield		Grain per acre
	Grain Seers	Straw lbs.	Seers
Basumathi	228	360	3,040
Chintamani Sanna	288	453	3,840
Halubbalu	228	387	3,040

Mr. Dodbasaviah, Patel, Shikaripur:

"When I sowed the 661 strain of paddy for the first time in my lands, the moisture conditions were not favourable and the crop did not appear to come up uniformly. I had almost decided to plough up the land and sow it with local paddy when the Agricultural Inspector suggested to me that the seedlings from patches where they had grown might be transplanted in the whole area. The plot was manured at the rate of 75 lbs. of ammonium sulphate and 60 lbs. of concentrated superphosphate and transplanting done as suggested. From ½ an acre so treated 10 pallas of this strain of paddy was obtained, whereas the local paddy yielded only 6 pallas in a similar area. It appears to me that S. 661 is a good strain of paddy. I tried strain 246 in 10 guntas of land. It yielded 437½ seers of grain, while the local paddy in the same extent of land yielded 300 seers. The cultural and manurial treatments were the same in the case of both the paddies. Therefore S. 246 is also a good strain."

Sugarcane

Mr. Muddubasaviah, Sugganahally, Closepet Taluk:

"Last year I planted H. M. 320 variety of cane in a demonstration plot. It grew more vigorous and taller than

the local variety, *pattapatti*. In a four-gunta plot H. M. 320 gave 9,580 lbs. of cane. On being milled, this quantity of cane yielded 1,239 lbs. of jaggery. This works out to 42⅔ tons of cane or 442½ mds. of jaggery per acre. *Pattapatti* gave for an extent of four guntas just 6,242 lbs. of cane, which on boiling yielded 846 lbs. of jaggery. This works out 27¾ tons of cane or 302½ mds. of jaggery per acre. The neighbouring raiyats after seeing this have planted H. M. 320 in their lands also this time."

Mr. Seenappa, Harohally, Bidadi Post, Channapatna Range:

"I planted the 2,000 setts of H. M. 320 cane given by you for demonstration in a plot of 8 guntas. Half of this, *i.e.*, 4 guntas was manured with ammonium sulphate and the other half received only cattle manure. In another 4 guntas by the side of this, I planted local *pattapatti* with ordinary manuring. I give the results hereunder:

	Weight of cane for 4 guntas	Blocks of jaggery	Tons of cane per acre	Jaggery Mds. per acre
Pattapatti	4,032	465	18	170
H.M. 320 (ordinary manure) ..	6,466	646	28·9	236·2
H.M. 320 (treated with ammonium sulphate) ..	7,492	752	33·4	274·2

This indicates that H. M. 320 yields better than *pattapatti*. Yields are even better if ammonium sulphate is given to the H. M. 320 crop."

Mr. Dodbasiah, Shikaripur:

"Last season, I planted H. M. 320 and local *pattapatti*, each in 10 guntas of land. H. M. 320 resulted in 5½ tons of cane and the local in 4 tons. This time I have planted H. M. 320 in 2 acres."

Mr. B. Chowdiah, Tattikere, Holenarasipur Taluk:

"Co. 290 cane planted in 400 pits, yielded 5 mds. of jaggery, when the crop from it was milled. Local cane from

a similar piece of land yielded 3 mds. of jaggery. The new cane is better than the local."

White Gingelly *(Sesamum)*

Mr. Dyave Gowda, French Rocks Taluk:

"I sowed ¾ seer of white gingelly in 3 acres of land as a mixture crop. It gave in all an yield of 2 pallas. I preserved 6 seers for seed and sold the remaining quantity at Rs. 12 per palla. The price of black gingelly at this time was Rs. 9 to Rs. 10 per palla. In my experience white gingelly yields better than the local. I am trying to distribute it among my neighbours."

Mr. K. G. Shivappa, Kalpanahally, Davanagere Taluk:

"I obtained an yield of 175 seers per acre from white gingelly against only 150 seers from the black variety."

Mr. Mahanthappa, Malebennur, Harihar Sub-Taluk:

"I obtained an yield of 160 seers per acre from white gingelly against 120 seers from the black variety."

Mr. A. P. Channabasappa, Anaji, Davangere Taluk:

"The white gingelly grown for demonstration in my lands yielded 240 seers per acre. Black gingelly yielded only 200 seers per acre."

Poovan Plantains

Mr. G. V. Chickveerappa, Kasba Hobli, Hoskote:

"Seventy out of 100 suckers given to me survived and grew up into good plants. At the time of reporting bunches are ready to be harvested. Each bunch has on an average 190 to 250 plantains. In my experience the bunches of local variety do not have so many fruits. All-told Poovan Plantain is a profitable crop to the raiyat."

Manurial Trials

1. *Paddy.*

Mr. Narase Gowda, Pala Agrahara, Nagamangala Taluk:

"Thirty-one guntas of land were treated with 100 bundles of *honge* leaves and 3 cartloads of farmyard manure and

Chintamani Sanna paddy was transplanted in ten guntas of this land without further manuring. To another ten guntas of this land 18¾ lbs. of ammonium sulphate and 15 lbs. of concentrated superphosphate were applied on 24–2–1938 and this bit of land was transplanted with the same variety of paddy. The different plots were severally harvested on 3–6–1938, the one manured with fertilizers supplied by the Department gave 700 seers of paddy and 50 bundles of straw, while that which received only the ordinary treatment gave 550 seers of paddy and 40 bundles of straw."

Mr. G. Shantiaveerappa, Chairman, Village Panchayat, Koralakunte, Challakere Range:

"I applied ¾ md. of ammonium sulphate and 1 md. of superphosphate to 10 guntas of land and only cattle manure to 10 guntas and transplanted the same variety of paddy in these plots. The fertilizer plot yielded 350 seers of paddy and the other 210 seers."

Mr. Chinnayya, Topasagara, Molakalmoru Taluk:

"In the season 1937–38, I was given by the Department ½ md. of ammonium sulphate and 1 md. of superphosphate which I applied to ¼ acre of paddy. I grew another ¼ acre with the fertilizer for comparison. The fertilised plot yielded 336 seers of paddy but the other 256 seers. The proportion of empty seeds was less in the fertilised crop."

Mr. Kumari Gowda, Chikkade Village, French Rocks Sub-Taluk:

"I applied 75 lbs. of ammonium sulphate and 60 lbs. of concentrated superphosphate to a plot of 10 guntas and transplanted it with paddy. The yield worked out to 2,600 seers of paddy per acre. From a similar plot, unfertilised, the yield worked out to 2,290 seers of paddy per acre."

Mr. Siddappa, Hadisettihally, Seringapatam Taluk:

"Ten guntas of land that received fertilizers yielded at the rate of 2,456 seers of paddy per acre whereas the unfertilized plot yielded at the rate of 1,652 seers per acre."

Mr. Gose Gowda, Nagenhally, Seringapatam Taluk:

"Ten guntas of land that I treated with fertilizers gave

an yield of paddy at the rate of 1,616 seers per acre, whereas the unfertilised plot gave an yield of paddy at the rate of 1,368 seers per acre."

Mr. B. Suryanarayana Rao, Kasaba Hobli, Chikballapur Taluk:

"The fertilised plot yielded me 960 seers of paddy and 30 cartloads of straw and the plot manured in the ordinary way yielded me 760 seers of paddy and 26 cartloads of straw to the acre."

2. *H. M.* 320 *Sugarcane.*

Mr. G. M. Siddaramappa, Vice-President, Municipal Council, Shikaripur:

"From 1⅓ acre of land in which I grew H. M. 320 cane, I got 468 mds. of jaggery and 10,000 setts. In my experience cane which goes to make 3,000 setts when crushed yields 6½ mds. jaggery which means 173 mds. as equivalent of 80,000 setts. In this area the fertilised portion yielded me at the rate of 46 tons of cane per acre and the portion that received only cattle manure 40½ tons per acre."

Mr. Gaviappa, Shikaripur:

"I grew cane in 10 guntas of land according to Departmental suggestions. Fertilizers were used for 5 guntas. Five guntas received only ordinary local manure. Five guntas that were fertilised yielded 12,884 lbs. of cane whereas the other plot yielded 11,343 lbs. H. M. 320 grown in my plots were better than the local cane grown in neighbouring lands."

Mr. Gurubasiah, Shikaripur Taluk:

"Both H. M. 320 and local canes were grown in 10 guntas each. These plots were given each 2½ mds. ammonium sulphate and ¼ md. concentrated superphosphate. Other cultural operations were the same also. H. M. 320 gave 7¾ tons of cane in ¼ acre; the local cane gave 5⅝ tons in ¼ acre."

Mr. Basavanna, Patel, Shikaripur:

"Five guntas of fertilised plot yielded me 7,390 lbs. of cane as against 5,640 lbs. from 5 guntas unfertilised."

3. *Chillies.*

Mr. Krishnegowda, Ankanhally, Closepet Taluk:

"The seedlings started better in the fertilised plot than in the check plot. Later the crop suffered from drought; still the half gunta of land that was fertilised yielded 22 lbs. of dried chillies where one gunta of land unfertilised, double the fertilised plot yielded 25 lbs. That means manuring with fertilizers is beneficial."

The Silver Jubilee of the Mysore Agricultural School, Hebbal

The Mysore Agricultural School at Hebbal celebrated its Silver Jubilee on the 15th of November 1939. As the School is celebrating its 25th year, it is worth remembering the Farm on which the School is now located is more than 34 years old. The connection of Hebbal area with science of plant introduction takes us back to eighteen-eighties. In the time of Mr. Cameron and Mr. Ricketts (the potatoes grown in Mysore are known by the name of the latter), so it is stated, the Hebbal butts plantation was established and many new trees introduced, such as rain tree, ceara rubber, and shingle tree, etc.

The Hebbal Agricultural Farm was started in the year 1905. The Government of Mysore sought the advice of Mr. (afterwards Sir) Mollison, the Agricultural Expert with the Government of India. He and Sir P. N. Krishna Moorty, the then Dewan of Mysore, inspected and selected a site near Hebbal to locate the Farm. Government sanctioned the starting of the Experimental Farm in their Order No. 10989 –41 Agri. 149–03–32 dated 6th May 1905. The reports of the Agricultural Department for 1908–09 contain a detailed description of how the old experimental plots of the Hebbal Farm were proposed to be laid.

On the Farm so scrupulously laid out sprang the Agricultural School in 1913. How some of the old departmental and sectional heads began teaching the first batches of

Distinguished Visitors at the Silver Jubilee of the Mysore Agricultural School

students here is an interesting picture to bring before one's mind. By the time they handed over the School to the younger generation the School was reorganised as a three years' course leading to licentiateship in Agriculture. Dr. Coleman and Mr. A. K. Yegnanarayana Iyer were the guides of the School and were the source of inspiration to the teachers. A residential institution having the hill, the tank and the village for its environment, Hebbal imparts to its students a rural spirit.

With the ragi, groundnut, cotton, togari, sunflower and Napier grass systematically arranged in the extensive dry area newly acquired, statistical plots here and there, the lively poultry farm and many other modifications, it is difficult to imagine how Hebbal would have looked of old.

The Silver Jubilee meeting commenced at 5 p.m. on 15–11–1939 under the distinguished presidentship of Rajamantrapravina K. V. Anantaraman, B.A., Member of Council in Mysore. There was a good gathering of ladies and gentlemen befitting the occasion of the Silver Jubilee and among the distinguished persons present were Sir Charles Todhunter, K.C.S.I. (Private Secretary to H. H. the Maharaja), Mr. S. Abdul Wajid, B.A. (Revenue Commissioner in Mysore), Mr. J. Appaji Gowda, B.A. (Hons.) (General Secretary to Government), Mr. Abdul Aziz Khan, B.A. (Deputy Commissioner, Bangalore District) and Mr. A. K. Yegnanarayana Iyer, M.A., N.D.D. (Retired Director of Agriculture and one of the early organisers of the Mysore Agricultural School). Mr. T. G. Rama Iyer (Director of Agriculture) most cordially received the guests.

Invocation over, the Principal of the School welcomed the President and other invitees and read his report reviewing the work of the School from its inception to date. The President then distributed certificates and medals to the several successful students of the School and prizes to the winners in the Silver Jubilee Competitions. Mr. R. G. Shama Rao, B.Sc., L.Ag., was the recipient of the Gold Medal awarded to the candidate who takes the first rank among the

successful candidates, and five more prizes. After the distribution of prizes, the President spoke in no uncertain terms that the School should be organised in a way to attract proper rural candidates and that it should be able to look to more of its old boys taking to improved agriculture. The function concluded with a vote of thanks to the President and three cheers to His Highness the Maharaja of Mysore. The students later enacted a few dramatic pieces.

M. V.

The Government Experimental Farm and the Mysore Agricultural School, Hebbal

[*From the Report of Mr. M. Narayana Reddy, B.Sc. (Edin.), Principal*]

I. The Farm

The area of the Farm when it was first started was 21 acres 19 guntas dry lands and 9 acres 19 guntas wet lands under the Hebbal tank. To this a further area of ten acres dry and ten acres wet lands were added in 1911–12. In 1914 a further area of 22 acres were added thus bringing the total area of the Farm to 63 acres and 6 guntas. In 1933, the Rifle Range of the British Military authorities was abandoned and an area of 164 acres were made available for the Hebbal Farm, thus bringing the total to 227 acres, distributed as under:—

12 acres cultivable waste.
18 ,, grassland.
17 ,, 29 guntas wet lands.
180 ,, dry lands.

Standardised plots were originally laid out into 4 gunta and 2 gunta plots; ½ acre and 1 acre plots have been laid out within the last two years and more areas of the Farm have been brought under cultivation, so that to-day, the area under cultivation has doubled itself.

The following important trials are under way:—

1. Testing varieties of ragi in statistical plots. This is the first time such an accurate experiment has been laid out on the Farm.

2. Rotation Experiment—ragi and groundnut.

3. Testing varieties of groundnut.

4. Testing other dry crops such as castor (*Ricinis communis*), *avare* (*Dolichos lablab*), *hurli* (*Dolichos biflorus*), *togari* (*Cajanus indicus*), *chillies* (*Capsicum annuum*) and *navane* (*Sevania italica*).

5. Test on a very large scale (to the extent of 15 acres) thin Napier grass. A waste land, poorer than any gomal land in the State, has been utilised for growing this grass. This wonderful grass has attracted all India attention and that of our keen ryots.

6. In the wet area, trials with varieties of paddy.

7. An exhaustive test of various sugarcanes, such as canes evolved in Mysore, canes from Coimbatore and finally, irradiated canes (*i.e.*, canes evolved by treatment with X-ray).

8. Thorough tests of some of the finest cottons and work of hybridization is being done by the Botanical Section.

9. Compost making.

Animal husbandry work done on the Farm:—

1. Poultry breeding work—White Leghorns, Rhode Islands and Black Minorcas.

2. Improvement of sheep—Merino and cross-bred sheep.

3. Improvement of the milk yield of the *hallikar* cow. A modest dairy is also attached to the Farm.

Bee-keeping on a small scale is also carried on the Farm.

Some outstanding contributions by the Hebbal Farm towards agricultural improvement in the State are, *viz.*,

1. H. M. 320 sugarcane, now grown on a large scale in the Irwin Canal tract.

2. K. 1 and H. 22 ragi.

3. H. G. 1 groundnut.

4. Napier grass—Seeds of this grass enough to grow 1,400 acres have been distributed in the State as a beginning.

5. Distributing White Leghorns and Rhode Islands for breeding purposes.

II. The Mysore Agricultural School

The Mysore Agricultural School located on the Farm giving a two-year course in agriculture was started in the year 1913, with provision for the training of about 15 students per year. Instruction is imparted in English and is of the grade that may be compared to the Diploma Course in many of the Colleges of Agriculture in British India. It is a residential institution, and the bulk of the instruction, *i.e.*, Agriculture, both theory and practice, is in the Farm itself, while for instruction in the Sciences---Physics and Chemistry, Botany and Biology and for Veterinary instruction, the students were in the first few years brought over to the laboratories and the Veterinary Hospital in Bangalore. As the institution expanded, all the classes were transferred to the Farm itself where suitable buildings had been built. A Veterinary Hospital was also built on the Farm so that the School is now self-contained in all these respects. Provision for the imparting of instruction in smithy, carpentry and fitter's work has also been made in the Farm Workshop. A Dairy was also started with small herd of local cows and buffaloes and the necessary dairy appliances such as separators, improved churns, etc., for practical instruction in cream separation, butter making and milk testing.

In the year 1920, the courses were revised and the School reorganised into an institution giving a three-year course leading to Licentiateship in Agriculture. Up till now 289 successful students have been granted the Diploma of the School.

A number of these have been employed in the Mysore State Department of Agriculture and in the Mysore Sugar and Tobacco Companies. A number of them have gone back to their lands.

Speech of *Rajamantrapravina* K. V. Anantaraman, Second Member of Council, on the occasion of the Silver Jubilee Celebration of the Mysore Agricultural School, Hebbal, held on the 15th November 1939.

Mr. Rama Iyer, Ladies and Gentlemen,

My first duty is to thank you for the very cordial and friendly welcome that you have extended to me and for the kind congratulations and good wishes that you have offered me on the honour conferred on me by our beloved Ruler, His Highness Sri Krishnaraja Wadiyar Bahadur. I have been wanting to pay a visit to the School for quite a long time but for one reason or another, I have not been able to do so till now. So, when Mr. Rama Iyer invited me to visit the School to-day and preside over its Silver Jubilee celebrations, I accepted the offer with readiness as it afforded me an opportunity not merely to visit the School and study its working but also to join you in celebrating an important event in the history of the School.

2. From the statistics that have been placed at my disposal and the report that has been read to us by the Principal just now, I find that the School which began its career in a small way has gradually grown both in size and in the scope of its work. To begin with, instruction was limited to agriculture and the scientific studies directly connected with it. The scope of the studies now includes Dairying, Animal Husbandry, Veterinary Science, Poultry Farming and Bee-keeping. The successive Directors of Agriculture and Principals of the School are entitled to great credit for this steady development.

3. Twenty-five years is not a long period in the life of an institution of this kind, but nevertheless it is an important period as it marks a very definite stage in its growth. It is permissible, and I believe also useful, on an occasion like this to look back in retrospect on the difficulties, disappointments and achievements of the past and to look on the prospect ahead and consider our hopes and ambitions for the future.

4. What exactly was the object for which the School was started? The report that has just been read to us shows that the School was started with a view to provide up-to-date knowledge in the theory and practice of modern agriculture to young men desirous of going back and settling on their lands after the completion of their studies. Has this object been achieved, and if it has not been, why has it not been achieved? The answer to the first part of the question is, I regret to say, in the negative to a large extent. Though the School was meant to train young men who go back to the land, still in practice the majority are after service. To a certain extent this is understandable, and even inevitable, but when it is found that out of 290 persons who have passed out of the School, only 30 have gone back to the land, the object that the founders of the School had in view must be held to have failed. The report does not show how far even this small number of 30 persons has made use of and profited by the knowledge acquired by them in the School. Some disconcerting reasons have been given for this unfortunate result. It has been stated that the vast majority of students look to service rather than to return to their lands. The reason for this preference is described as the enjoyment of the amenities of urban life and the consequent unwillingness to go back to the villages and live the hard and rugged life of the villagers. It is added that the villages at present provide no attraction for our young men who have had glimpses of urban life! This, I must say, is a damaging statement, naively made, and constitutes a most scathing attack on the policies and purposes of this institution. The great problem of the time is the prevention of the trek into towns by the creation of greater amenities and activities in our villages. That in fact is the problem of rural reconstruction which leading public workers and administrations are trying to solve. It is indeed a tragedy that an institution avowedly created to improve the efficiency of agriculturists and agricultural methods should work to take away young men from agriculture. Another reason that has been assigned for the reactionary mental attitude is the fact that

agriculture except in irrigated tracts is a gamble due to the vagaries of the monsoons. The purpose of this School and of the application of science to agriculture is to fight this precarious condition. It is not a forlorn hope that the Agricultural Department and the institutions fostered by it are leading. It is because we believe that by careful and concerted action the prospects of agriculture can be improved, that we have gone ahead with the development of the Department's activities. Our attitude in this respect has been fully justified by the results so far achieved and in prospect of achievement. By the adoption of improved methods of agriculture, by the cultivation of new crops of a drought-resisting nature, by the economical use of water, by the careful selection of manures suitable to particular crops and kinds of soil, and by the organization of useful industries subsidiary to agriculture like sheep and cattle breeding, poultry farming, and bee-keeping, much has been done to improve the resources of the raiyats.

5. It has been stated that a diploma-holder of this School will be a more suitable candidate for employment even in other departments than that of agriculture because he has knowledge of the farmers and farm life and can appreciate their difficulties. This does not harmonise with the statement that the students who pass out of this School have no desire to go back to their villages. The advice or assistance of such people to the farmers in the villages who are in a hopeless position reminds one of the old saying—"Do as I tell you and not as I do." No good can ever come out of such advice or sympathy.

6. So far as I have been able to study the problem, I think that the trouble has developed by reason of the failure to keep to the road which was originally marked out for the institution. The raising of the initial qualification for admission, the expansion of the curriculum so as to include a considerable amount of theoretical knowledge, the adoption in the School of the standards of life and thought prevailing in urban secondary schools, and the inadequate attention paid to practical training on the field have all contributed to this

result. Raising the qualification for admission definitely discriminated against the young men from the villages, few of whom, owing to inadequate facilities, both in the way of schools and of resources, pass the S.S.L.C. standard. What then is the remedy? Are we to continue on the present basis, creating newer and more difficult problems every year? If I may say what I strongly feel on the subject, the first step should be to re-adjust the qualification for admission so as to enable us to get more young men from the villages into the School. Instruction should be imparted in Kanarese. Greater attention should be devoted to practical training by work on the land. The conditions of life in the School should not be out of harmony with the conditions in the villages. The School authorities should keep in touch with the passed out students and make use of them for carrying on their trials and demonstrations on the field. And the Department of Agriculture should help such of the students as have not got lands to acquire lands from the Revenue Department. These are the lines on which action is likely to be fruitful.

7. I must apologise to you for speaking at some length on a somewhat unpleasant matter on the occasion of a joyful celebration. As I started by saying, it is not inappropriate when the School stands at a definite stage of its career and we are anxious that the fullest benefits that its originators hoped to achieve should be secured, that we should review what has been done and reform our methods wherever they have been found to be faulty.

8. Before I conclude, I wish to express the hope that this institution, suitably reorganised, will steadily grow in usefulness and service to our agriculturists and that, when the time comes for the celebration of its Golden Jubilee, it will have a bigger record of achievements to show.

The Ramakrishna Krishi Shala Day

Ramakrishna Krishi Sala which owes its origin to the munificent endowment of Mr. G. Venkataramaniah, Pleader, Bangalore, is one of the successful Kannada Agricultural Schools in the State. It is situated in the Anekal Taluk, about 18 miles from Bangalore on the Bangalore-Chandapur-Anekal Road.

The Ramakrishna Krishi Shala Day was celebrated on the 16th November 1939, with much eclat under the presidency of Rajamantrapravina K. V. Anantaraman, B.A., Member of Council. On his arrival at the Shala premises, the Member and the Revenue Commissioner were received by the Director of Agriculture and taken round the Experimental and bulk plots. They were then photographed with the staff and students of the Shala along with a few guests.

After lunch, the assembly commenced with the Member of Council in the Chair. Invocation and *Lavani* being sung by the students of the School, the Assistant Director of Agriculture of the Bangalore Circle, read the School Report. A few owners of demonstration plots came forward and expressed their opinions severally on the demonstrations they had taken on hand. After the distribution of certificates to such of the successful candidates that were present, the Member rose up amidst cheers and said, "My especial thanks are due to you for the kind congratulations you have offered me on the honour conferred on me by His Highness the Maharaja of Mysore." It was not the first time he was visiting the School, the Member continued, but he had previously inspected the School and attended its annual school-days. He said the School owed its origin essentially to the liberal donations and constant efforts of his friend Mr. G. Venkataramaniah, who, he said, was more a man of action than a man of words and used to go to him both when he (the Member) was the Deputy Commissioner of Bangalore and then the Revenue Commissioner, not to ask for anything for himself but to request that an additional donation he was going to make may be accepted.

The Member then expressed his appreciation of the report that the number of students was increasing, that the area under cultivation was extending, that attention was devoted specially to the practical side of teaching. He said that this was the way to make agriculture more remunerative. He knew the difficulties that beset the workers, but expressed that success would be theirs and the efforts of the School Managing Committee and the Department of Agriculture are much to be appreciated in this regard. Though no immediate answers could be given to the several requests made in the report, the Member said that Government are really interested in the Institution for the solution it affords for rural and unemployment problems, and that all possible help would be rendered so that the institution may be able to carry on its good work.

The Member then congratulated the passed candidates and advised them that they should remember the big start in life the School has given them and that they should bring a name to the institution by their success in their occupation. He gave some sound advice to students who were still in the School to take interest in their practical work, learn all that the School had to teach and that they should not be discouraged by reports of failing rains, as this is a complaint common to all countries and as scientists have shown the way to carry on agriculture in spite of drought and difficulties. He finally wished a long and steady usefulness for the School.

The Donor in replying announced amidst cheers a further endowment of Rs. 2.000 for sinking a well (Rs. 1,000) and for giving instruction in weaving (Rs. 1,000) in the School.

The Director of Agriculture thanked both the Donor and the Member of Council.

After the Chairman was garlanded and flowers were distributed the functions of the day came to a close with the singing of the National Anthem.

M. V.

Ramakrishna Krishi Shala

(From the Report of the Assistant Director of Agriculture, Bangalore Circle, Dr. B. Dasappa, B.A., B.Ag., Ph.D., D.I.C.)

The Institution owes its origin to the munificent endowment of a large landed estate, extending to about 270 acres in area in the villages of Kittaganahalli, Kachanaikanhalli and Ramakrishnapur by Mr. G. Venkataramaniah, Pleader, Bangalore City, in addition to a handsome amount of Rs. 10,500, a few head of cattle and a cattle-shed. The Donor has presented another sum of Rs. 2,000 on the occasion of the 10th School-Day celebration, for the construction of a well and equipment in connection with instruction in weaving. After the Government took over the lands in 1927, they gave a subvention of Rs. 7,000 per annum for the first two years and Rs. 5,000 per annum after that period till 1935; they have been giving Rs. 3,500 per annum now and they have recently approved of the receipts from the School lands to be utilised for improvements on the spot. The present School building, staff quarters and other buildings were constructed during 1929.

The School lands have been much improved since the School was started and the neighbouring villagers are volunteering themselves to take up for lease the uncultivated lands. Prior to the year 1937, 54 acres of dry and wet lands were under the direct cultivation of the Shala and about 59 acres of dry land and 14½ acres of wet land were cultivated by the tenants. Since 1937 the area under cultivation by the Shala direct is extended to 80 acres and the dry lands under lease to 65 acres. The major portion of the labour required for the cultivation of the Shala lands is done by the students themselves.

The School was opened in 1929 with a batch of 15 students. The medium of instruction being Kannada and the course extending originally over one year. The number of students admitted which ranged from 12 to 16 prior to

1937, was raised to 32 in that year. It was felt that one-year course was not enough and it is now made into one of two years. The first year is devoted to theoretical and practical instruction and if the students come out successful in the examination held by the 'Board of Examiners of the Kannada Agricultural Schools', they will be promoted to the second year and will be given intensive training in all the branches of agriculture, farm management and maintenance of farm accounts, etc. The certificate will be awarded only after the student finishes his second year course to the satisfaction of the Board. A group of students is allotted a plot of every crop cultivated on the farm and they have to carry out every farm operation on this plot from start to finish. Thus every student will have worked on all the crops grown on the farm. He has to submit a forecast of next day's or next week's work to the Head Master, who will scrutinize the same and issue necessary instructions. Four students of the 1937–38 batch underwent the second year's course voluntarily. In view of the extension of the course 19 students were admitted to the School last year and 19 students have been taken this year bringing the total strength to 32 this year (excluding the failed students). Spinning is also included in the curriculum of instruction. The institution does not charge any fee for instruction and the students are boarded out of the Shala produce and lodged free.

One hundred and fifty-two students have passed out of the School till now. Some of them are taken as fieldsmen in the State Agricultural Department and most of them have been looking after their lands. The Mysore Sugar and Tobacco Companies have provided occupations for some of the students.

Proceedings of the Twentieth Annual General Meeting and Field-Day of the Mysore Agricultural and Experimental Union, Bangalore

The Field-Day was held at the Government Experimental Farm, Hebbal, on the 15th of November 1939, simultaneously with the Silver Jubilee of the Mysore Agricultural School, Hebbal. The members had the opportunity of seeing a large number of varieties of ragi, paddy, sugarcane and other crops, Merino and cross-bred sheep and poultry at their best.

Members assembled for the Annual General Meeting at 2–30 p.m. with the President, Mr. T. G. Rama Iyer, B.A., Director of Agriculture in the Chair. There were more than 35 members present and a considerable number of visitors.

The meeting began with an invocation and welcome song in Kannada, composed by Mr. K. Doreswamy of the staff of the Union for the occasion and read by himself.

The Secretary of the Union then read his report for 1938–39 and submitted the statement of accounts for the period ending 30th June 1939, published elsewhere. This was considered and duly passed by the members.

The President then made a few observations acknowledging the able service rendered by the members of the Union in acting as a medium for transmitting the benefits of Departmental research to the fields of the farmers. He explained the system of subvention farms, where several good varieties of seeds or several manurial treatments will be tried in the fields of progressive raiyats for selection of the best variety or manurial treatment best suited to the locality. The owner of the field is compensated for his trouble by a subvention. He explained also the scheme of demonstration plots in raiyats' fields where the benefits of improved varieties and manurial treatments would be demonstrated free on a small extent of the raiyats' holding. He explained also the scheme of seed-farms where pure seed would be lent for multiplication and the bulk seed purchased by the Department at a premium for distribution. He invited the

co-operation of the members to participate in all these schemes which would benefit them and their fellow-agriculturists.

The following resolutions were proposed by the Chair and passed *nem con*:—

1. "*Resolved* that this meeting of the members of the Mysore Agricultural and Experimental Union desires to convey to the Government of His Highness the Maharaja of Mysore, through the Director of Agriculture in Mysore, its deep sense of gratitude for the continued interest they are evincing in the work of the Union by granting an annual subvention of Rs. 2,000 towards the expenses of the Union, for two years from 1939–40."

2. "*Resolved* that this meeting of the members of the Union desires to convey its congratulations to Lokaseva-parayane Sri. D. Sakamma, one of the long-standing members of our Union on the honour graciously conferred upon her by His Highness the Maharaja of Mysore."

3. "*Resolved* that this meeting of the members of the Union desires to convey to the Director of Public Instruction in Mysore, its deep sense of gratitude for his kind patronage and requests that all the middle schools may kindly be induced to subscribe to the Kannada Journal of the Union."

4. "*Resolved* that the Revenue Commissioner in Mysore be requested to kindly help the Union by recommending the purchase of copies of the Kannada Journal by the Village Panchayats."

5. "*Resolved* that the Mysore Agricultural and Experimental Union be registered under the Rules of Regulation No. III of 1904 for the registration of Literary, Scientific and Charitable Societies."

Mr. A. G. Krishnaswamy then proposed and Mr. M. S. Ramachandra Rao seconded the following resolution which was also passed *nem con*:—

"*Resolved* that a recommendation be made to Government for the sale of seeds, manures and implements at cost price in the case of cash transactions."

The Managing Committee for 1939–40 was then elected:

1. Mr. T. G. Rama Iyer, B.A. (*President*).
2. „ B. Venkatanaranappa, M.A. (*Vice-President*).
3. „ S. Venkataswamy Gowda
4. „ M. J. Narasimhan, B.A.
5. „ M. S. Ramachandra Rao, B.A., B.L.
6. „ B. Shankara Rao Badami, M.A.
7. „ G. Venkataramaniah
8. Major C. B. Oakley, V.D., A.M.I.M.E.
9. Mr. T. S. Raghavachar, B.A.
10. „ T. Lakshmana Reddy.
11. „ B. V. Venkatacharya, B.Sc. (Agri.)
12. „ M. Vasudeva Murthy, B.Ag. (*Secretary*).

The President then thanked the members for having responded to the invitation.

M. Vasudeva Murthy,
Secretary.

Subvention Farms

Proceedings of the Government of H. H. The Maharaja of Mysore

Read:—

Correspondence ending with letter No. S.M. 445/529/38–39 dated the 9th March 1939 from the Director of Agriculture in Mysore, stating that in connection with the experiments about comparative yields of several varieties of Mungar jola and Nadam cotton, the Assistant Director of Agriculture, Mysore, has arranged with Mr. N. Viraraja Urs of Nilsoge for leasing out about 5 acres of land on the following conditions and recommending sanction to the arrangement for a period of five years and the payment of the subvention of Rs. 25 per year the expenditure being met from the contingencies of the Mysore Circle during those years.

The party will place at the disposal of the Department a plot of ground about five acres in area. He will cultivate the land, manure it, sow the seeds given by the Department and raise the crop and harvest the various strains and varieties separately under the direction of the Departmental agency.

He is to be permitted to take the produce himself.

Any seed from the plot irrespective of the quantity, required by the Department will be supplied by him on payment at the prevailing market rates.

A room in his house will be kept at the disposal of the Department for storing the various strains of jola or cotton to be tried in the locality.

The party may raise any pulse crop which usually come in rotation in the area without any interference to the sowing of the jola or cotton crop in the same plot.

The Departmental Officers should co-operate with the party in seeing that the seeds are sown in time and thus avoid any loss due to any avoidable delay on the part of the Officers.

The party is to be paid a subvention of Rs. 5 an acre or Rs. 25 on the whole for the co-operation he extends to the Department for conducting experiments of the sort in the ryots' fields.

Order No. D. 8393-94/Agri. 178-38-4 Dated Bangalore, 28th March 1939.

Sanctioned.

(*Sd.*) K. Srinivasan,
For Secy. to Govt., Dev. Department.

OBITUARY

V. N. Ranganatha Rao, L.Ag.

By the sudden death of Mr. V. N. Ranganatha Rao, L.Ag., Economic Botanist, on the 2nd December 1939, after a brief illness, the Mysore Agricultural Department lost a very devoted and successful plant-breeder. The late Mr. V. N. Ranganatha Rao comes of a family which has rendered meritorious service to Mysore. He was the nephew of Mr. Vijendra Rao, Chief Secretary to Dewan Sir K. Seshadri Iyer. He had his agricultural education in the Nagpur Agricultural College and his training in plant-breeding under Dr. R. J. D. Graham, formerly Economic Botanist, Central Provinces, now Professor of Botany at the University of St. Andrews. He was also a pupil of Mr. R. J. Allen, C.I.E., now Commissioner of Agriculture, Baroda. Mr. Ranganatha Rao had the greatest admiration for these two professors and up to the last day he was in correspondence with Dr. Graham who had a high regard for his old student.

Mr. V. N. Ranganatha Rao spent most of his service in plant-breeding work on cottons in Mysore. The results of his work are of far-reaching benefit. He has evolved several strains of Asiatic cottons for the black cotton soil area of nearly 70,000 acres in the Chitaldrug District. Of these (*Herbaceum* 190) better known as H. 190, is the best. It is a cross between *Gossypium herbaceum* and *Gossypium arboreum*. Its cultivation is extending fast as it has a high-yield, a ginning percentage of 30, a staple length of almost 1 inch and a spinning capacity of over 30's warp counts and a silky feel. Other strains evolved by him for the black cotton soil area which are under statistical tests are Strain 19 and Nadam-like. These are also gaining in popularity with the raiyats. To drive out of cultivation the short staple *Bokda* cotton which was seeking a habitation on Chitaldrug on account of its high ginning percentage, he evolved a cross between *Gossypium cernum* and *Gossypium obtusifolium* (Nadam). Though somewhat wanting in slikiness his *Cernum*-Nadam crosses are heavy yielders with medium staple, a very high ginning percentage of 37 and spinning capacity of 25's warp counts. These are found useful on account of wilt resistance inherited from the *Cernum* parent and very clean for picking.

In evolving new strains of *hirsutums* Mr. Rao has also rendered meritorious service. The scope for cultivation of New World Cottons in the red sandy loams of the Maidan Districts in Mysore is very great.

Mr. Rao obtained a good cross between Mysore Doddahatti (acclimatised Upland cotton known to the trade as Banavar cotton) and a tree cotton answering the description of a Peruvian. This cross, M.A. II, with a ginning percentage of 30, spinning capacity of 25 to 30's warp counts and a staple length of 7/8 inch is a most prolific yielder under Mysore conditions of all the New World Cottons grown in India. Individual plants with over 100 bolls are not uncommon. He was engaged during the last three years in evolving an Asiatic cotton with wilt resistance and a high ginning percentage. His crosses now in row tests are H. 190 × *Cernum*-Nadam 4–5 and Strain 19 × *Cernum*-Nadam 4–5. He has also made new crosses to further increase the lint length and ginning percentage of M.A. II which has a great future in Mysore.

Mr. V. N. Ranganatha Rao's death has deprived the Mysore Agricultural Department of a very able plant-breeder who has rendered meritorious service to his State.

—By Courtesy *"Current Science"*.

SELECTIONS

Suggestions for Inducing Polyploidy

The following suggestions may be helpful in polyploidy experiments with colchicine. An accurate knowledge of the stages of meiotic phases of flower buds and the rate of activity of meristematic parts or young seedlings treated is vital for successful results. No effect may be expected from treating vegetative parts that are not growing vigorously. It is unlikely that colchicine will affect cells that are not active, since (as is indicated in the text), the colchicine solution is an agent that, by being diffused into active cells, disturbs the cell-division mechanism. Inactive or dormant cells may be affected only if they become active while colchicine is still present in them in sufficient amount to affect the cell-division mechanism.

Different plants may require different concentrations of the chemical for the most effective result. Solutions of colchicine as low as 0·025 per cent. and as high as 2 per cent. have been used experimentally. However, it is believed that most plants will yield results with the application of a 0·2 per cent. solution. It is advisable to divide up the samples of the material to be treated into groups and apply to each sample a different concentration of solution. The length of treatment may also be varied, using from 1 to 16 hours. The method of application may be by wetting, immersing or soaking, depending upon the material to be treated. The part to be treated may be wetted either with the aid of a camel's-hair brush or by placing on these parts a small amount of absorbent cotton thoroughly saturated with the solution.

The suggestions as to the treatment of different types of material are as follows:—

1. *Producing Diploid or Higher Polyploid Pollen Grains and possibly Polyploid Eggs.*—Wet with or immerse in colchicine solution young flower buds before or after meiotic chromosome pairing, or at the time of meiotic metaphase. Duration of immersion may be one hour or longer. This method is to produce polyploid gametes and by their union polyploid embryos. The question whether polyploid pollen grains produced will be functional or not may be determined only after trials, since in some species of plants polyploid pollen grains have not been functional on diploid individuals, while in others such a combination has succeeded.

2. *Inducing Polyploidy by affecting Embryos at the very beginning of their development.*—In plants like strawberry (*Fragaria*),

blackberry (*Rubus*), Petunia, tobacco (*Nicotiana*), and in many other plants where the embryo development is not deep-seated, young fruits may be treated by thoroughly wetting with colchicine or immersing in a solution for one hour or longer at the beginning of embryo development. Before embryos are initiated, the treatment may prevent embryo development entirely. The time of embryo development may be days (five to six days in strawberries)*; or weeks (about three weeks in grapes and peaches),* and at times, a year (the family of pines), after pollination. There often seems to be a break between the time of fertilization and actual embryo development, which should be determined to obtain satisfactory results.

3. *Inducing Polyploidy in Very Young Seedlings.*—Seeds may be germinated on filter paper or elsewhere. One- or two-day-old seedlings may be soaked in solution for three or more hours (depending on the size of seedlings, planted in pots, and covered lightly with soil. Young seedlings already in soil, if they can be handled conveniently, may be uprooted, washed and treated as above. Seeds of strawberry were treated and no results were obtained (judging from the external appearance of the young plants), while the treatment of the seedlings reacted favourably. We now have from this source a number of plants of *Fragaria vesca semperflorens,* that pollen grain examination indicates, are polyploids. The difference in the reaction between seeds and seedlings seems to be due to the fact that the latter are actively growing, hence they react to colchicine treatment, while the former are dormant at the time of treatment. The success of seed treatment in the cases reported by Blakeslee and Avery seems to be due to the fact that the seeds treated by them may normally germinate quite soon after the treatment, while in the strawberry it requires about a week to germinate, by which time the colchicine in the seeds planted in the soil may be so diluted—if not diffused out entirely—that it is not present in sufficient quantity to have any effect on the mechanism of cell division in the dividing cells of germinating seeds.

Distorted growth often witnessed in the colchicine-treated young seedlings may be due to a prolonged treatment. Such an effect may possibly be prevented if seedlings are exposed to the drug for a shorter period, then washed in water for a short time to stop further effect of the colchicine.

4. *Inducing Polyploidy in Growing Tips.*—Growing tips are either wetted with or immersed in the solution for three to sixteen hours. Rapidly growing plants will react to the treatment more favourably than slow growing ones. If tomentose tips of plants are

* From original observations not yet published.

wetted with 0·1 per cent. Aresket, the colchicine solution will penetrate between these hairs and reach the epidermis and diffuse through it more effectively.

The author was able to produce tetraploid cells in root-tips of apple, cherry, lima bean, peach, and sweet corn by placing young seedlings in ice water at a temperature of 1° C. to 3° C. for two hours. Similar results were obtained by placing very young seedlings in hot water at 35° C. for one hour. Much shorter time and a little higher temperature for hot-water treatment may give better results, while with ice water, the time may be extended without injury to the seedlings. Heat treatments were given to the young seedlings of apple, cherry and peach.

High percentage of polyploid pollen grains may be more successfully produced by treating young flower buds, at proper stages of pollen-mother cell development, with low or high temperature than with colchicine. Diffusion of colchicine solution into the anthers may not be rapid and even, while the temperature effect is, comparatively speaking, immediate and even.

Tetraploidy or higher polyploidy of resulting plants may be first detected by comparing stomata of leaves of normal and affected plants, or by the size difference of pollen grains produced. The affected parts are either propagated by cuttings or by seeds that may be obtained by selfing the flowers. The type of polyploidy may be accurately determined by the chromosome counts from root-tips of cuttings and seedlings.

—*The Journal of Heredity*, Vol. 29, No. 6.

Breeding Poultry for Egg Production

Breeding poultry for egg production is a very important part of the operations on a poultry farm and requires to be well carried out if future success is to be assured. Of all the breeds used for commercial egg production in this country, the White Leghorn is the most popular, although the Australorp and Rhode Island Red also have been developed to a large extent here. The White Leghorn is essentially an egg-producing breed; it lays white eggs, and belongs to a group of fowls known as "light breeds". While not considered, by any means, to be included in the table class of poultry, large numbers are sold for this purpose on the local market. The Australorp belongs to a group known as "heavy breeds" and lays brown eggs. While this is considered to be a dual-purpose breed, *i.e.*, a good layer and also one suitable for the table, as a table bird it has not the superior quality and the desired colour of legs and flesh possessed by some of the other heavy breeds.

The opinion is often expressed that "like begets like". In general, this is true, but it is true for general and not for particular qualities. It is a fact that a male White Leghorn mated to White Leghorn females will breed birds that are White Leghorns, or that have white plumage, yellow legs and white earlobes, but of these progeny there will be no two birds exactly alike. We find large and small Leghorns; some lay large eggs and others small eggs, and we find a great variation in the number of eggs produced by different hens.

Selection is made on the basis that like will produce like, but experience has taught breeders that, to secure uniform superiority, they must carry on the selection for generations. If birds with desirable qualities are selected, it should not be expected that all their progeny will have those same desirable qualities, but a better average will be obtained than had no selection been made at all. It is essential that the breeder should realize that the various characters of the fowl are inherited separately.

Breeders are paying more attention to the size of egg as well as to numbers than has been the case in the past. At the commencement of egg-laying trials, the number of eggs, regardless of size, was considered to be of particular importance, and high prices were paid for birds laying about 300 eggs in twelve months. We have since learned that the number of eggs laid is by no means the whole of the story, and that, unless competition birds have a potential breeding value, they are worth very little, and laying trials will have no permanent value. In fact, under such conditions, egg-laying competitions may be more harmful than beneficial, as by breeding from birds of this description the tendency is to neglect other standards of quality which may be of equal importance. The results now obtained in laying competitions throughout the world have demonstrated the possibilities of improving the average egg production on commercial poultry farms, and competitions carried out by State Governments render a very distinct service to the poultry industry, since the records are accepted as official. In the Burnley Egg-Laying Competition, conducted by the Department of Agriculture, the prizes are awarded for the greatest number of first-grade eggs laid in 48 weeks. Every egg is weighed and recorded, and these records are available for examination by any competitor, who can thus compare the performance of various birds and, if he wishes, ascertain the weight of every egg laid by his birds throughout the period of the competition. During the first two months, a first-grade fowl's egg must have weighed not less than 1¾ oz., and thereafter not less than 2 oz. It is of interest to note that in this competition the percentage of first-grade eggs laid has increased during the last twelve years from 79·8 per cent. in 1925–26 to 97·6 per cent. in 1936–37.

The housewife dislikes buying small eggs unless they are exceedingly cheap. The small egg generally causes dissatisfaction and tends to lower the average price of all eggs sold, and thus results in a loss to the poultry farmer.

There is no doubt that egg size is inherited. But it must be remembered that, although certain strains may have inherited the factor for laying large eggs, the eggs may decrease in size through errors in feeding and general management. It should be the aim of all engaged in the industry to breed from birds that are free from this undesirable fault, as food and marketing costs are approximately the same as for eggs of normal size. If the small egg is not eliminated, there is also the risk that they may be used for incubation, resulting in a general deterioration of the flock and an increasing number of small eggs. It is true that some large birds lay small eggs and some small birds lay large eggs. It is a fact, however, that loss of weight within a breed is usually followed by laying of small eggs and degeneracy in that breed.

Inbreeding is the mating of relatives. There is what is called "close inbreeding," as full brother and sister mating, and there is inbreeding of very distant cousins, which certainly could not be regarded as close inbreeding. The mating together of males and females that are full brothers and full sisters is the closest form of inbreeding that can be practised. The final results secured under any form of inbreeding depend, to a great extent, upon the kind of stock used in the original inbred mating. It has been observed that the results of inbreeding are not so harmful in some strains as in others. Investigators have shown that the immediate effect of close inbreeding is a marked decline in hatchability, that it increases chick mortality, and has a detrimental effect on the constitutional vigour and number of eggs produced.

Although there is no definite type or system of measurement by which we can select birds for laying with certainty, the first essential is the selection of those that have the characters wanted for egg production. It should be realized that the fundamental basis for selection is ancestry and constitutional vigour. A bird should appear bright, active and healthy. It should be mature, well developed, of normal size, and have a vigorous constitution, giving evidence of ability to transmit similar qualities. The eye should be full, prominent and bright. The bird should have a good depth of body, with a long broad back and a straight breastbone. It should be tight in feather, free from any constitutional weakness and other abnormal faults, and be bred from a family of high egg producers.

The question of age of the breeding stock has received much consideration. The ideal mating is a fully matured cockerel with

second season hens, the reason being that the male is then in his youthful prime and vigour, while the females presumably have been tested as pullets and are more likely to produce large chickens that will thrive well. Older breeding birds that have produced proved offspring should be treasured as the most valuable possession of the breeder.

The number of females that should be mated to one male is a question that cannot be answered off-hand, as much depends upon the breed, upon the stamina and vigour of the male bird, and upon the conditions under which the birds are kept. With light breeds, the number of females to one male would vary from 8 to 16 or even 20, and with heavy breeds from 6 to 12.

Birds for breeding should be reared under natural conditions, given as much free range as possible, and should be fed on a variety of plain wholesome meals properly balanced, succulent greenstuff, and clean grain.

—*The Journal of the Department of Agriculture*, Victoria, Vol. XXXVI, Part 7.

Prussic Acid Poisoning of Livestock

Many wild and cultivated plants in Florida contain glucosides which may liberate prussic or hydrocyanic acid—an extremely poisonous compound—and are known as "cyanogenetic" plants on this account. These plants when eaten under certain conditions contain enough of poisonous prussic acid to cause illness and frequently death among cattle, horses, sheep and goats. Losses of stock from prussic acid poisoning have not been widespread in Florida, but conditions have arisen at times whereby they have been quite serious.

Cyanogenetic Plants.—Only a few of the many cyanogenetic plants have been reported as causing poisoning of livestock. Some are totally unpalatable, while others occur on native ranges in quantities too small to be dangerous. Some common cyanogenetic plants native to or cultivated in Florida, which have been or may be the cause of prussic acid poisoning, are listed below. These have been identified by Erdman West, Mycologist at the Florida Experiment Station.

Bitter cassava root, *Manihot utilissima* Pohl.; cherry laurel, *Laurocerasus caroliniana* (Mill) Roem.; Johnson grass, *Sorghum halepense* (L.) Pers.; sorghum, *Sorghum vulgare* Pers; Sudan grass, *Sorghum vulgare* var. *sudanense* (Piper) Hitchc.; wild cherry, *Padus virginia* (L.) Mill.; wild plums, *Prunus americana* Marsh., and *Prunus angustifolia* Marsh.; yellow jessamine, *Gelsemium sempervirens* (L.) Ait.f.

Chemistry of Prussic Acid Poisoning.—Prussic acid does not occur normally in the free state in plants, but rather in chemical combination

in compounds known as glucosides. Glucosides themselves are non-poisonous. The prussic acid must be liberated from the glucosidal combination before the animal can be poisoned. The liberation is brought about by enzymes, which free the prussic acid from the remainder of the glucoside. In this condition the plant is a potential source of danger to livestock.

Factors Affecting Glucoside Content of Plants.—The amount of glucoside found in a cyanogenetic plant varies with the amount of readily available nitrogen in the soil, and with climatic conditions that prevailed during its growth. More of the glucoside may occur in young plants, especially second growth, than in mature plants, and more in those grown in well-fertilized or high-nitrogen soils than in low-nitrogen soils. Second growth sorghum, in particular, is usually considered a dangerous feed in the green state. These plants synthesize more glucoside when their growth has been retarded.

Plants that have been injured by wilting, bruised from any cause, stunted by drought or low temperatures, often contain enough prussic acid to be potentially dangerous to animals. These cyanogenetic plants, killed by frost, are highly dangerous for several days, since prussic acid is liberated in recently-killed plant tissues.

Ordinary Precautions against Poisoning.—The quantity of glucoside in a nomal well-nourished plant usually is not great enough to be dangerous to animals, but caution is advised in placing animals on any pasture containing cyanogenetic plants.

Slow curing into hay or fodder, or ensiling, tends to liberate the prussic acid and allow it to evaporate. The forage so treated usually may be eaten without danger. Certain processed seeds such as flaxseed meal (especially from immature flax) and linseed oil meal when damaged by mold have caused death in sheep and cattle from prussic acid poisoning.

When there is reason to suspect a high glucoside content in a crop about to be grazed or used for soiling, it is well to check this forage by the method commonly used in the sorghum belt, before allowing an entire herd access to it. This method involves a trial with a single animal of relatively low value (an average yearling, or an old cow), for a half-hour, watching it closely. If this test is satisfactory, repeat the test with two or three animals. With no untoward results, there is little chance of hazard in its use. Usually, it is well for cattle to have a fill of other feed before being grazed on fresh Sudan grass, Johnson grass, or sorghum, so that there is little chance that an excess quantity of the forage will be eaten. It has been claimed that the hazard is reduced somewhat by the presence of starchy feed in the paunch of animals grazing on Johnson or Sudan grass.

Only 0·0002 per cent. of the cow's live weight of free prussic acid (1/30 ounce for a 900-pound animal) is a lethal dose.

When clearing fence rows along a pasture it is well to remove entirely plum, wild cherry, cherry laurel, yellow jessamine and similar glucoside-containing plants from the reach of any livestock. Wilted foliage of these plants is palatable, is extremely poisonous, and has been the cause of several deaths of livestock reported to the Florida Agricultural Experiment Station each year.

The action of prussic acid is very rapid and if an animal becomes noticeably ill, it usually dies in a few minutes, before treatment can be administered. In the case of suspected prussic acid poisoning, it is well to withdraw other animals from the feed until the conditions have been investigated and the source found.

When using any variety of sorghum (either sweet or grain sorghum) as silage, certain definite precautions should be taken, namely:

1. Allow no animals to eat the wilted litter that accumulates about the silage cutter. Failure to observe this precaution caused the death of 12 cattle in one day on a Florida farm.

2. Do not start feeding the freshly-cut material. Close the silo, and allow the ensiling process to be fully completed (four to six weeks) before starting to feed it.

3. Open the silo a full day in advance of the first feeding, so as to allow normal evaporation from the freshly exposed surface of the silage.

Symptoms of Prussic Acid Poisoning.—Initial symptoms consist of laboured breathing and a staggering gait. In fatal cases the animal is unable to stand and a partial paralysis of the tongue and limbs develops. Death follows soon by respiratory paralysis and suffocation. This is due to alteration of the red blood cells whereby the normal exchange of gases between the tissues and blood cannot occur. Blood in the veins of animals dead of prussic acid poisoning retains the bright red colour of arterial blood.

Treatment.—Concerning treatments, James F. Couch, Chemist in the Pathological Division of the Bureau of Animal Industry, U.S. Department of Agriculture, says:

"Recent studies by a number of investigators have developed new methods that are very promising for treating cyanide poisoning. Especially promising is the intravenous injection of a combination of sodium nitrite and sodium thiosulphate. For cattle two to three grams of sodium nitrite in water followed by four to six grams of sodium thiosulphate in water has protected against two minimal lethal doses. This treatment may be supplemented by injections of atropine, inhalation of ammonia, injections of glucose, or symptomatic treatment.

Since the use of these drugs is attended with some danger to an animal, a trained veterinarian should conduct or supervise the treatment."

Because of the rapidity with which prussic acid poisoning causes death, preventive methods must be used to avoid losses. A knowledge of the cyanogenetic plants, conditions which affect their content of glucoside, and the use of precautionary measures outlined place one in position to avoid losses among livestock from prussic acid poisoning.

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Recent Advances in the Cool Storage Transport of Fruit

BY

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The remarkable development of meat and fruit-producing countries as a result of the invention of modern refrigeration methods—enabling the transport of perishable freights over long distances without loss—is a feature of the last decade of agricultural history.

It is not generally realized, however, that the regular successful transport of fruit across half the world has been achieved only in comparatively recent years as the result of long and careful research and investigation both in the producing countries such as South Africa, Australia and New Zealand and also in the marketing countries. Britain, Germany and others. Most of this work has been done during the past ten years as the result of heavy losses in fruit cargoes and a brief survey of the problems encountered and the results achieved may be of interest.

The difficulties of fruit storage are due to the fact that the fruit is a living organism, the tissues of which are still actively functioning during the whole period of transport. The normal processes of respiration and of chemical changes associated with the natural onset of ripening cannot be stopped without injury to the tissues; and the aim of fruit refrigeration or cool storage is to retard those processes for the required period. Any consignment of fruit has, therefore, a definite potential period for cool storage beyond which deterioration and decay inevitably set in.

The diseases of fruit in cool store may be grouped under two headings, *viz.*, (1) the primary or so-called physiological diseases which are caused, not by fungi or bacteria, but by interference with the life-process of the fruit, and (2) the secondary diseases resulting from the growth of fungal and bacterial contaminations originating in the orchard and plantation. Of the former class are internal breakdown

or tissue-collapse and the various scalds; among the latter are the common rots associated with the blue and green moulds, the anthracnose fungi and other organisms whose spores may be found in abundance on the surface of fruit, in the air of packing sheds and orchards and on the gloves and hands of packers.

In the case of temperate climate fruits, such as apples and pears, the problems of cool storage were found to involve a study of many factors both before and during the actual process of storage. It has been found that the storage quality or capacity of fruit is influenced by the method of planting, manuring, cultivation, pruning, harvesting practice, climate, etc., and that different varieties demand different cool storage treatment.

Temperature, humidity and ventilation are most important factors and each variety of fruit has its own particular requirements in these respects. Stage of maturity, delayed storage, soil type, manuring and in the case of budded trees the influence of root-stocks are all of great importance in determining the storage behaviour of the fruit.

While temperatures may not be low enough to cause actual freezing injury, they may still be too low to permit of normal biological processes. Very high humidity in the store air is deleterious and lack of ventilation causing accumulation of the carbon dioxide of respiration to concentrations above 10 to 12 per cent. may result in the suffocation of the fruit.

Immature fruit may develop excessive shrinkage but overmature fruit, *i.e.*, fruit in which the ripening processes are well advanced cannot be held satisfactorily in cool storage. Pre-storage delay between harvesting and storage, is the source of increased storage troubles—both of a primary and a secondary nature. Generally speaking manuring has also a definite effect, often over a long period of time, on the keeping quality of fruits, thus, apples from trees heavily manured with ammonium fertilizers developed excessive storage breakdowns for several years after the application of manure and bananas grown in heavily-manured soil rapidly deteriorate in storage.

In the case of tropical fruits, investigations have in recent years been undertaken, principally so far as the British Empire is concerned at the Low Temperature Station established by the Empire Marketing Board at the Imperial College of Tropical Agriculture, Trinidad.

This Station was erected in 1930, at a cost of approximately £5,800, for the study of cold-storage transport of bananas; but has since then conducted many and important investigations into the cool storage of other tropical fruits and vegetables such as tomatoes, avocado pears, pawpaws, citrus fruits, etc. As regards bananas, the principal problem has been the determination of the "precise set of conditions suitable for the successful transport overseas and subsequent

ripening to an attractive yellow colour"[1] of banana varieties resulting from the plant breeding experiments at the College. Owing to the prevalence of Panama disease to which the main commercial variety (Gros Michael) of the West Indies is highly susceptible a concerted attack has been made during the past 10 to 12 years on the problem of finding a substitute which will conform to all the requirements of the Trade.

The banana is usually harvested quite green, periods of cool storage transport are relatively short (12 to 20 days) and the temperature is in the vicinity of 53° to 56° F.

The fruit is ripened in special rooms at a temperature of about 70° F. and marketed immediately.

The main problems therefore are the determination of "the correct stage of maturity at harvesting, and the precise conditions during transport and subsequent ripening which will ensure the product reaching the market in a neat and orderly bunch of attractive colour."[2]

Provided careful control of temperature, humidity and ventilation is seen to, in accordance with the individual requirements of the particular variety being handled, the green banana is not a difficult subject so far as the refrigeration biologist is concerned.

The main secondary storage diseases of the banana in various countries are as follows: Australia—anthracnose, squirter, black-end; West Indies—anthracnose, stem-end rot, cushion and main stalk-rots; Fiji and Samoa—anthracnose, black-end and main stalk-rots, etc.

All of these conditions are the result of infections or contaminations by fungi originating in the orchard or packing shed and developing subsequently on the ripening fruit.

Anthracnose is the well-known black spotting of the fruit with a depressed centre. "Squirter" is a condition practically confined to Australia, while the other rots are common in all banana cargoes.

Both "squirter" and anthracnose have been much reduced by attention to plantation hygiene; recent work in Australia by officers of the Council of Scientific and Industrial Research showing that trashing, *i.e.*, removal of dead banana leaves in the plantation, resulted in a marked reduction in infection by the causal organisms.

Main stalk-rots—often a feature of bunch cargoes—have been satisfactorily controlled by sealing the clean cut end of the bunch with vaseline immediately prior to shipment; and as black-end has been proved to be associated with the packing of "shingles", steps have been taken in Australia to encourage the packing of hand and clusters rather than of single fingers. Among the obvious main sources of storage

[1] Wardland, C. W., and McGuire, L. P., *Empire Marketing Board Bull.*, 1932, No. 60.

[2] *Ibid.*, 1933, No. 72.

trouble are rough handling, bruising and pre-storage delay. It will be readily understood that, particularly in tropical countries, exposure of fruit charged with spores of rot organisms in an atmosphere of high temperature and humidity cannot but result in increased susceptibility to storage rots. The development of these may be somewhat retarded in cool stores but as it takes many hours to bring heated fruit down to correct carrying temperatures much damage frequently results from this cause alone.

Citrus fruits are liable to a host of transport diseases and it is significant that most of these are the direct result of injuries received during harvesting and handling. The majority of rot-producing organisms are wound parasites, *i.e.*, they attack the fruit only through wounds or injuries, which may be extremely slight and quite invisible to ordinary sight.

It has also been found that the presence of one wounded overmature or infected fruit in a case is sufficient to accelerate deterioration of the rest of the fruit, probably owing to the development of ethylene gas.

Wrapping papers steeped in sterilizing solutions have given useful results in some cases by rendering the spread of rots from fruit to fruit more difficult, but the best results have been obtained by attention to harvesting and handling methods.

In a country such as Fiji, where shipping facilities provide opportunity only for periodic shipments of fruit, the questions of pre-storage delay and the reduced handling and bruising of fruits is of paramount importance.

There is no doubt that the solution of the problem of transport wastage is bound up with the provision of pre-cooling facilities and it is considered that in the Australian-South Pacific sphere ultimate success as a tropical fruit-exporting country must go to the region which is first in the field with adequate provision for the pre-cooling and holding of harvested fruit for the necessary period of a few or more hours immediately before shipment. The value of such facilities may be recognised also in the possible saving of a great quantity of fruit which matures between shipments and in the opportunity they provide for successful transport of the more perishable classes of fruits as pawpaws, avocado pears, custard apples, etc., for which an increasing demand may well be expected in southern markets. In this connection it is interesting to note that steps have been taken for the establishment of a pre-cooling plant at Rarotonga in the Cook Islands, the sum of £25,000 having recently been allocated for that purpose.

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